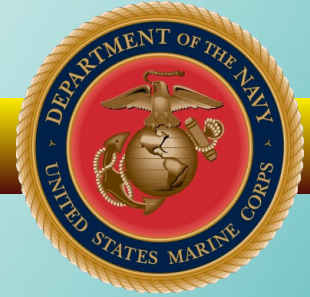
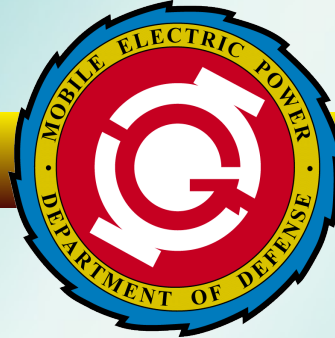


DOD Project Manager

Mobile Electric Power



Program Overview

for

USMC Power Conference

Camp Lejeune, NC

**12 - 13 July
2006**

**Bob Szerszynski
DOD Project Manager Mobile Electric Power**

Presentation Outline

PM MEP Organization



Requirements and Current Programs



Future Programs

- Advanced Medium Mobile Power Sources (AMMPS)
- Small Tactical Electric Power (STEP)



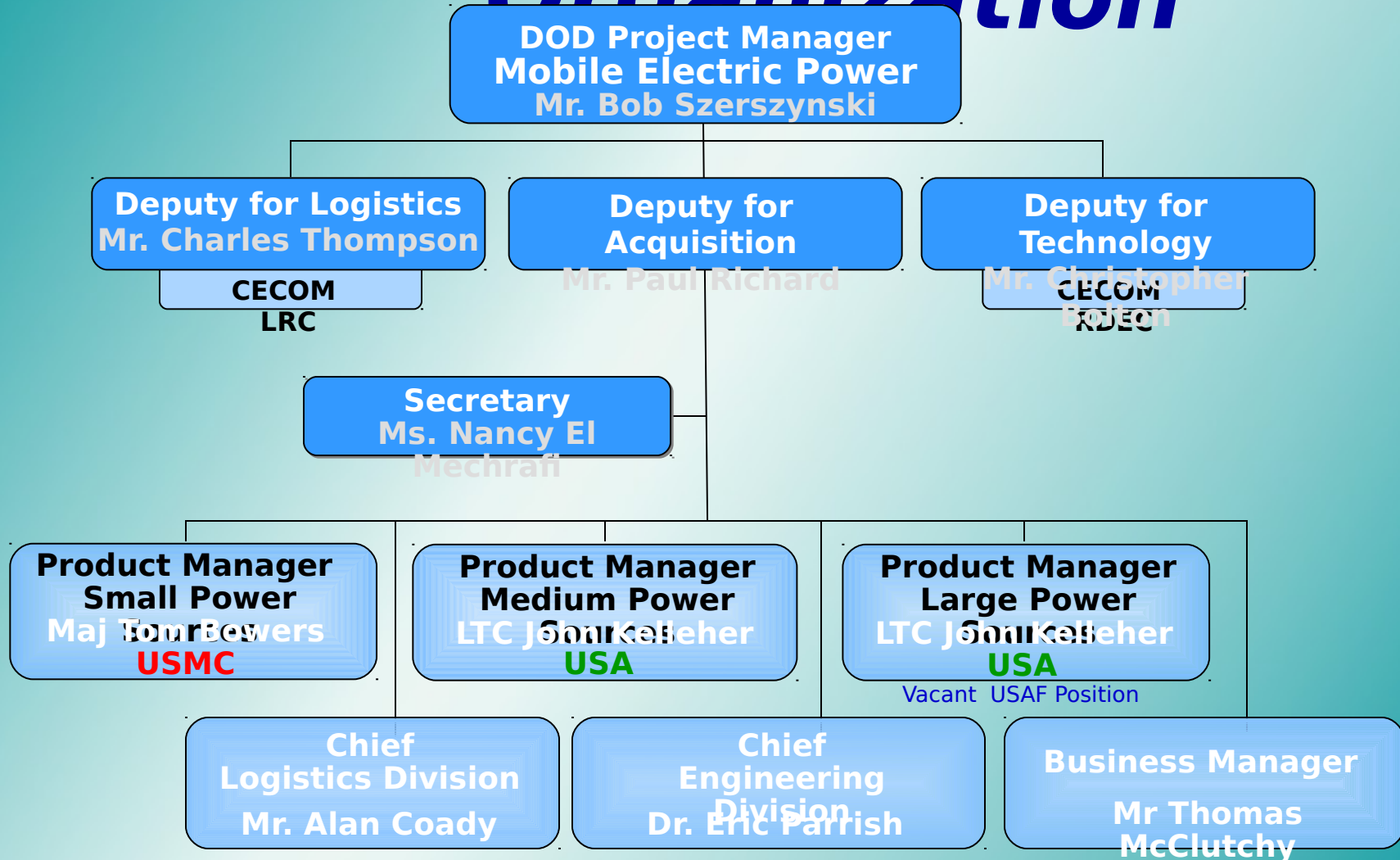
Lessons Learned

- Iraq/Afghanistan
- Hurricane Katrina Relief Support





PM MEP Organization





DOD Project Manager Mobile Electric Power Mission

Provide a Modernized Department of Defense Standard Family of Mobile Electric Power Generating Sources for All Services For Maximum DOD Component Use. Accomplish this Mission Through a Coordinated Inter-Service Effort to Develop, Acquire, and Support Mobile Electric Power Sources from Small, 0.5kW Manportable Generators to Large, 920kW and Greater Prime Power Systems.

Ref: DODD 4120.11

*Support for the Soldier, Sailor,
Airman, Marine*

JOP

Army Regulation 700-101
AFJI 63-110
NAVFACINST 4120.12
MCO 11310.8C
DLAI 4120.11

Joint Operating Procedures
Management and
Standardization
of Mobile Electric Power
Generating Sources



Power and Environmental Control Provided to All Services Across the Total Spectrum of Military Operations

Bare Base Power



920kW Bare Base Spt
Harvest Falcon
Harvest Eagle
Force Provider

Air Operations Power



5kW
(Airfield Spt
To 30kW
(Mobile Comm))

Naval Operations Power



5kW thru 920kW
Shore Admin Spt
To Naval Base Spt

Tactical Electric Power

Small Gen Sets



Large Gen Sets



Medium Gen Sets



ECU

Also : Power Units/Power Plants (PU/PP)
Auxiliary Power Units (APU), Power Distribution
Illumination System Electrical (PDISE) and
Environmental Control Units (ECU)

Air Defense Power

All Gen Set Sizes from
2kW to 100kW
(e.g. Patriot Spt Sys)



Army & Marines
2kW thru 100kW
Inf Plt Spt thru
Fire Spt,
C², & Comm

Combat Power



C4I Power

2kW thru 60kW
(Admin Spt thru
SATCOM and
Comm Switching)



Military vs. Commercial

Critical Military Features

- Diesel/JP-8 (DoD Policy)
- Operate at all Environmental Extremes
- Excellent Power Quality
- High Reliability
- Battlefield Mobility
- Ruggedized
- 24 Volt
- Enhanced Battlefield Survivability
 - NBC
 - IR
 - Aural
 - EMP Hardening
- Rated Power at Altitude
- Organically Supported

No Commercial Generator Set Meets Military Worldwide Requirements*

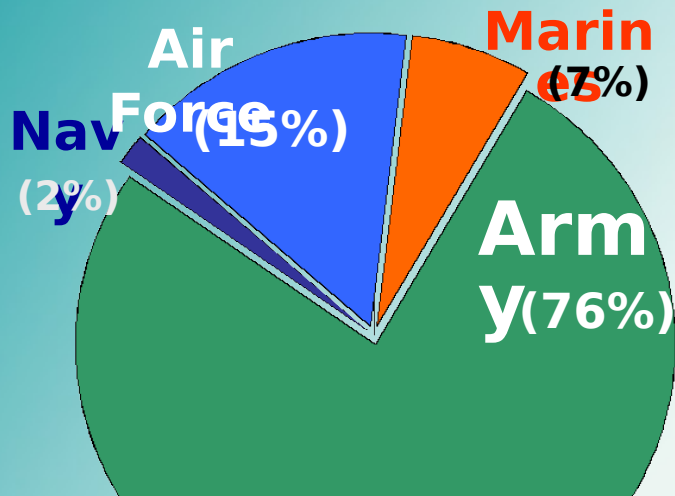
All Tactical Electric Power Generator Sets are Made from Commercial Components





Requirements

Power Requirements



Size	Army	% Army	Qty	%
Size Fielded	# Req'd*	Total	Fielded	
2kW	9,576	14%	8,155	
85% 3kW	19,122	29%	8,761	
46% 5kW	14,779	22%	8,625	
58% 10kW	12,001	18%	8,692	
72% 15kW	4,370	7%	2,948	
67% 30kW	3,085	5%	2,345	
76% 60kW	2,950	4%	1,684	
57% 100/200/DPGDS	568	1%	25	
4%				

MIL-STD = Military Standard 66,451 41,235
 First Generation Gasoline and Diesel Engine Generator Sets
 TQG = Tactical Quiet Generator
 Second Generation, Modernized, Diesel Engine Generator Sets

2kW thru 920kW Generator Sets (Does Not Include APUs)

Requirements	Fielded	
	MIL-STD	TQG
Army 66,451	25,216	41,235
Navy 1,540	721	819
Air Force 13,340	3,787	9,553
Marines* 6,423	305	6,118
Total 87,754	30,029	57,725

* USMC Requirements Under Review

Data Thru Apr 06

USMC

Most Recent Generator Set Procurement

2kW MTG 229

For delivery Nov 2006 - Feb 2007

Ongoing Generator Set Deliveries through 1QFY08

10kW TQG 621

30kW TQG 100

60kW TQG 684

100kW TQG 253

200kW TQG 79

Total
1,966

2kW - 200kW

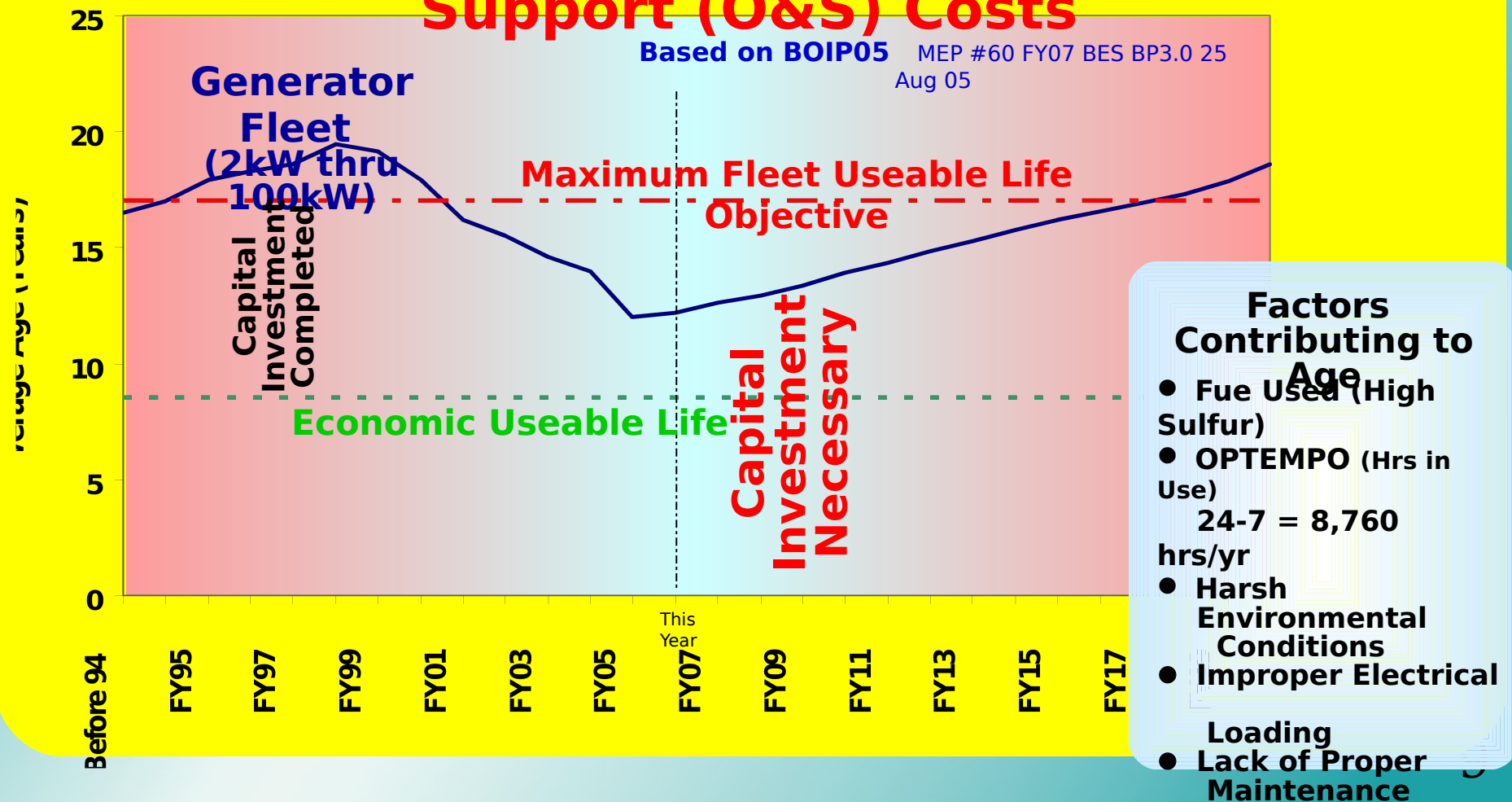
Sets

MTG - Military Tactical



Generator Set Age

Increasing Age = Increasing Operation and Support (O&S) Costs



Tactical Electric Power Families / Generations

Department of Defense *Standard Family of Mobile Electric Power Generating Sources*

MIL-STD

Military Standard

Aging, *First* Generation DOD Standard Family of Mobile Electric Power Generating Sources

- 37 Generator Set Models
- Sizes 0.5kW Through 750kW
- Gasoline, Gas Turbine, and Diesel Engines



Average Annual Cost Per Generator **\$13,347**



TQG

Tactical Quiet Generators

Modernized, *Second* Generation DOD Standard Family of Mobile Electric Power Generating Sources

- 18 Generator Set Models
- Sizes 2kW Through 920kW
- All Diesel Engines
- R&D On-going for Some Models



Average Annual Cost Per Generator **\$9,582**



Next Generation

Power Sources

AMMPS

Advanced Medium Mobile Power Sources

12 Generator Set Models
5kW through 60kW Sizes

Procurement
2008

STEP

Small Tactical Electric Power

Less Than
3kW Sizes
Procurement
~ 2013

LAMPS

Large Advanced Mobile Power Sources

100kW through
1mW Sizes
Procurement
~ 2018

- Leverage Commercial Technologies
- Minimize Number of Sizes and Models
- Use Proven Technologies
- Replace Entire DOD Generator Fleet Approximately Every 15 Years
- Maximize Competition

AMMPS
Average Annual Cost Per Generator **\$8,143**

Next Generation

TQG (Tactical Quiet Generator)

MIL STD (Military Standard)

1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025



Power Assessments and Central Power

What it is

Program to Assess and Optimize the use of Tactical Electrical Power Production and Distribution in the Field

- Improve Reliability, Maintainability & Readiness
- Reduce Fuel Consumption
- Improve Transportability
- Determine Most Efficient Use of Resources

1st CAV DIV MAIN TOC



V CORPS TAC CP - Grafenwoehr

Central Power

- Consolidate Power Sources in TOC
- Provide Back-up for Mission Critical Systems
- Decrease Logistics Footprint of TOC

INCREASED
Power Requirements
Due to Addition of
Specialized Digital Equipment.
Increased Power Requirements
Met by Central Power and
Power Distribution.

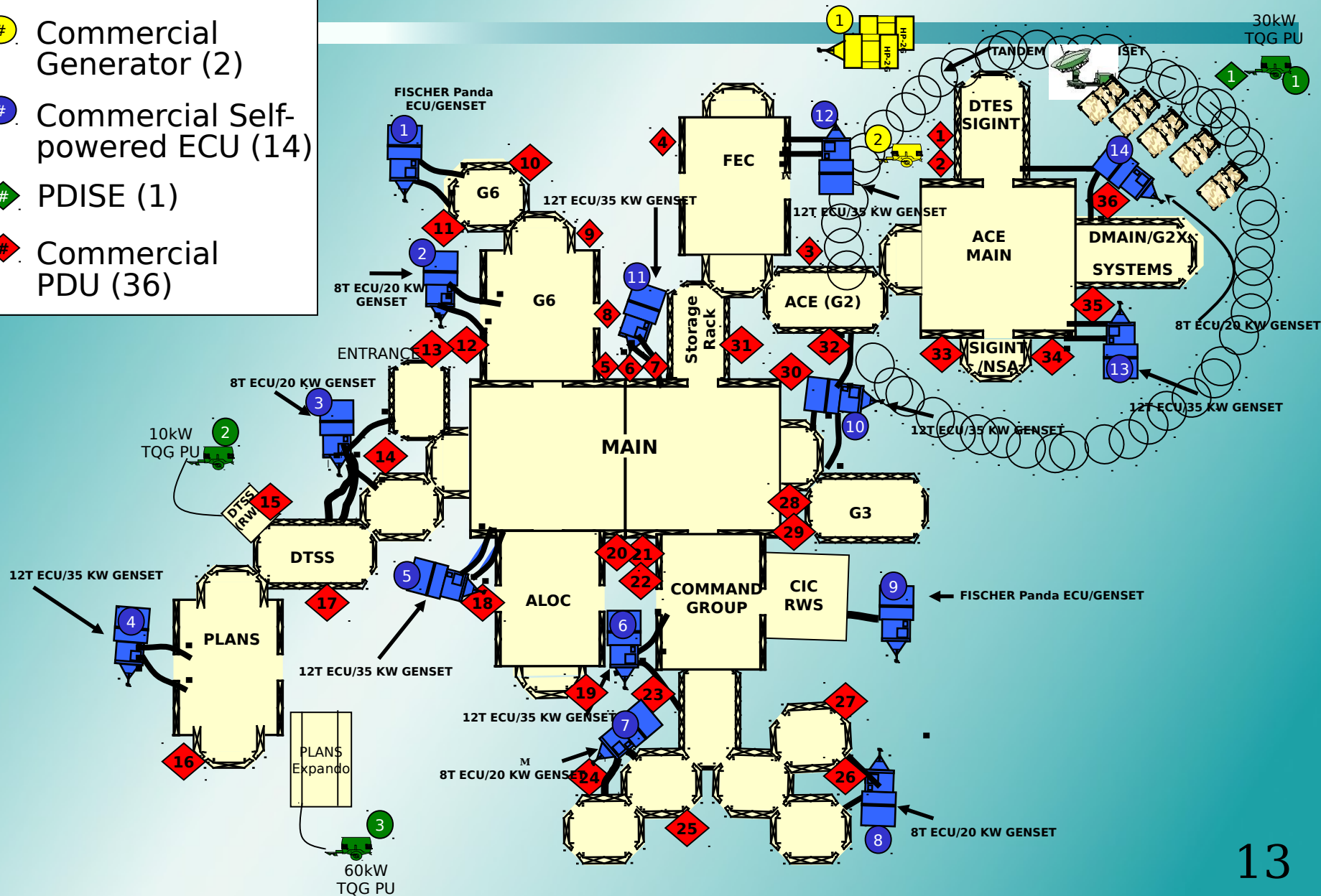
***“Right Number and Right Size
Generator Sets”***

Legend

- TQG (3)
- Commercial Generator (2)
- Commercial Self-powered ECU (14)
- ◆ PDISE (1)
- ◆ Commercial PDU (36)

4ID DMAIN As Seen

"BEFORE"

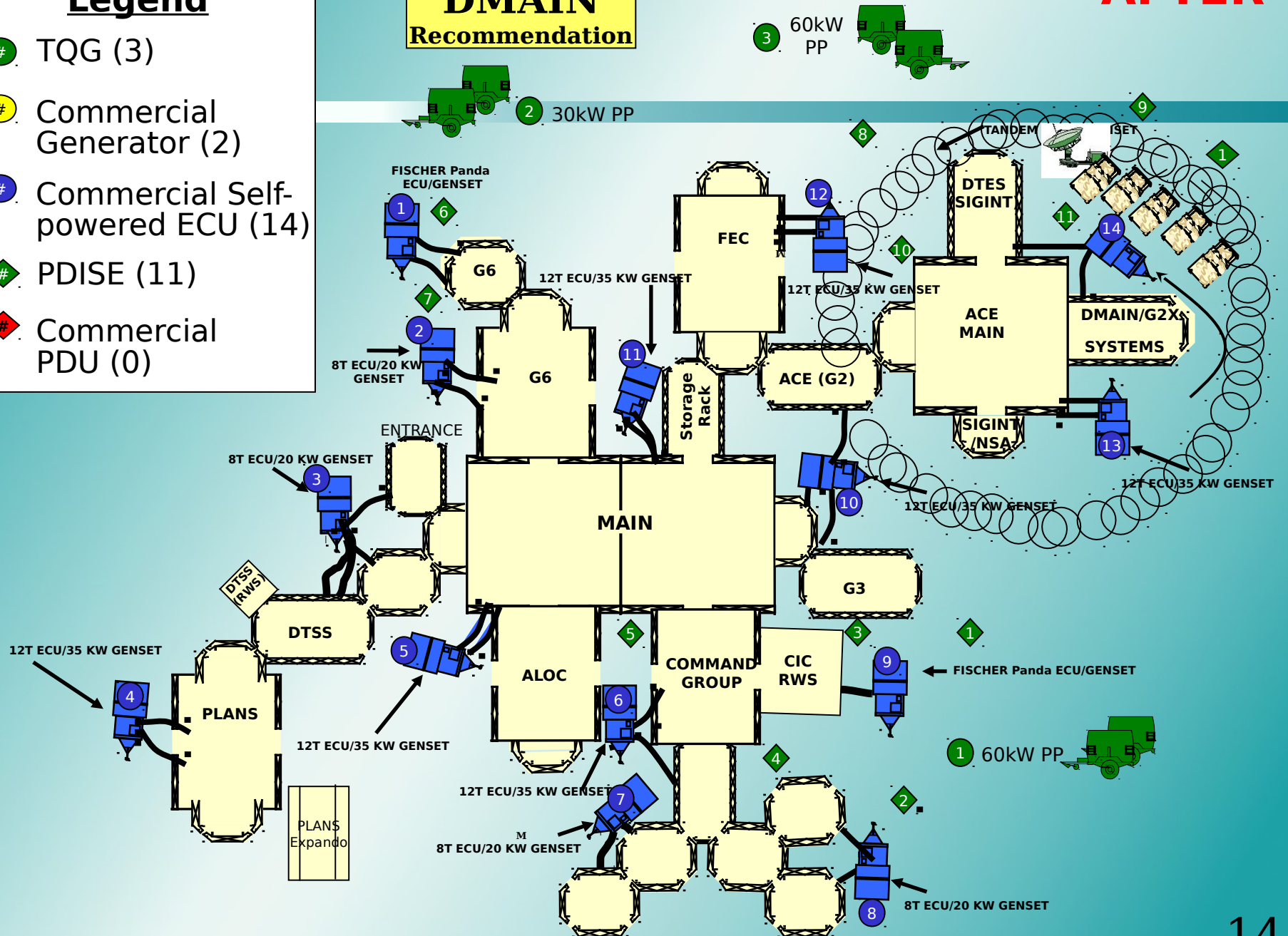


"AFTER"

Legend

- TQG (3)
- Commercial Generator (2)
- Commercial Self-powered ECU (14)
- ◆ PDISE (11)
- ◆ Commercial PDU (0)

41D DMAIN Recommendation



Power Assessment Benefits and Savings

Optimized power grid for:

- User safety
- 24/7 operation of mission-critical equipment
- Better reliability, supportability and readiness
- Minimum footprint and increased transportability
- Reduction of Non-standard Commercial Hardware
- Organic Support

When Central Power Design Applied to 4ID Main TOC MTOE, Savings are:

● **Generator Sets**

11

● **Fuel Reduction**

~ 200 gal/day

● **Weight (tons)**

23,353 lbs (~ 12

● **Volume**

4,735.2 cu ft

● **Reduced Pintle Requirement**

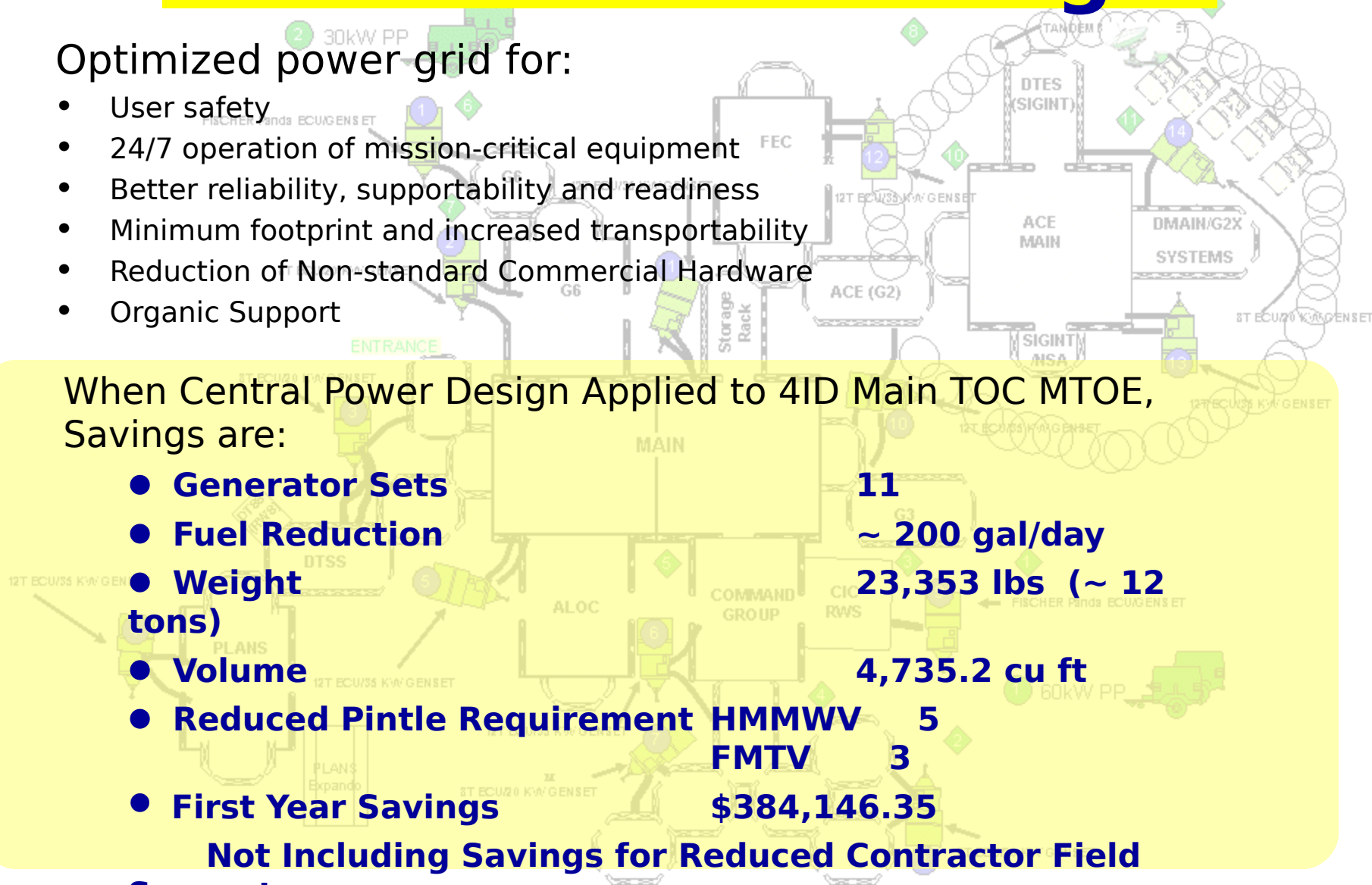
HMMWV 5

FMTV 3

● **First Year Savings**

\$384,146.35

Not Including Savings for Reduced Contractor Field Support



Power Distribution Illumination System

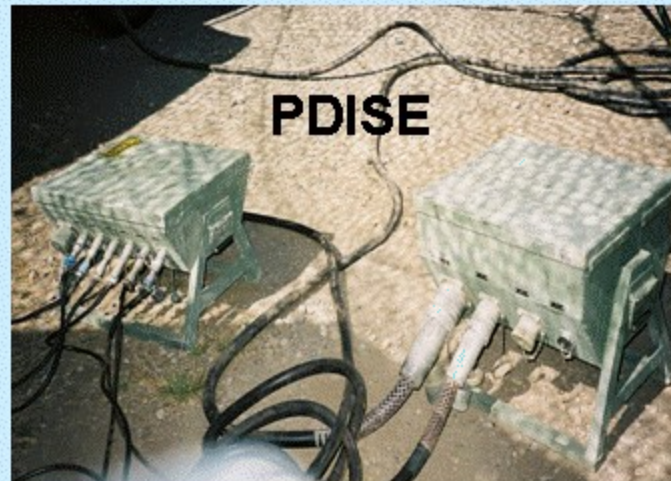
Electrical PDISE



WITHOUT PDISE



**S
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F
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T
Y**

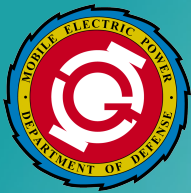


With PDISE





New Technologies s



Criticality of TEP & ECU

**Fuel is to HMMWVs and Helicopters,
Ammunition is to Howitzers,
and
Radar is to Target Acquisition
as**

***Electric Power and Environmental Control
are to Digitization***

NO Power
and/or
NO EC = ***NO Digitization !***
NO Modularity
NO Transformation

AMMPS - Advanced Medium Mobile Power Sources

Next Generation Tactical Electric Power Generating Sources

Program Goals

- EPA Compliant engines
- Improve Reliability/Maintainability
- Reduce Fuel Consumption/Size/Weight
- Reduce Noise
- Reduce Total Ownership Cost



PERFORMANCE is the Key

Thresholds

- Compared to TQG

10% Lighter
15% More Fuel Efficient
3 dBA Quieter
20% More Reliable
EPA Compliant

Potential Technologies

- Advanced High Speed Diesel Engine
- Permanent Magnet Alternator
- Power Electronics
- Digital Controls
- Composite Materials
- Other Technologies
- ? Microturbine Engine
- ? Fuel Cell
- ? Thermophotovoltaic
- ? Stirling Engine

Objectives

- Compared to TQG

25% Lighter
25% More Fuel Efficient
6 dBA Quieter
50% More Reliable
EPA Compliant

Future Power

AMMPS
Advanced Medium Mobile Power Sources

Commercial Generator Sets

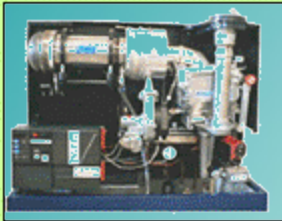
Cannot Meet Military Requirements

- Power Quality
- JP8 Fuel
- Altitude and Temperature Ranges
- HEMP and EMI hardened
- Ruggedized and Mobile

Small Tactical Electric Power (STEP)

Technical/Performance

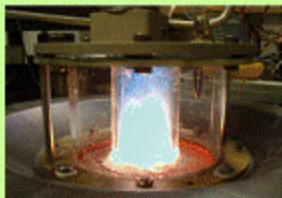
Power Output	0.5kW - 3.0kW
Hot & Basic Climate	-50°F to +135°F
Altitude Performance	Full rating @ 4,000ft, 95°F
	Operate up to 10,000 ft @ 95°F
Weight	142lbs (2kW)-293 lbs(3kW)
Fuel Consumption	0.25 gph
Fuel	Diesel/JP-8
Noise	67- 72 dBA @ 7m
50/60/400 Hz/ DC ?	
Reliability	750-1,250 hours
MTBEFF	



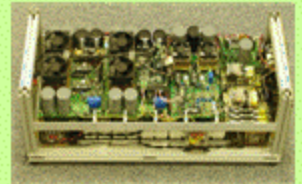
Stirling and
Rotary
Engines



Fuel Cells



Thermo-electric



Advanced Power
Electronics



Microturbine



Advanced IC
Engine

Program Objective

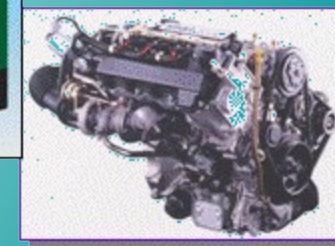
Develop and field:

- Soldier-portable power sources, 500 to 3000 Watts
- Use the latest technology
- Achieve significant performance improvements

over the current TQGs and MTGs.

Future Programs/Technologies

- **Advanced High Speed Diesel Engines**
- **Advanced Environmental Control Systems & combined Power/ECU Systems**
- **Power Electronics & Digital Controls**
- **Composite Materials & Light Alloys**
- **Diagnostic & Prognostic**
- **Microturbines**
- **Battery technology**
- **Stirling Engines**
- **Direct Energy Conversion**
 - Thermophotovoltaics



- Fuel Cells**
- **Tactical Inverters (Vehicle & Shelter)**
 - **Remotely Magnetically Alternating**
 - **On-Board Vehicle Boilers**

Technologies Must Satisfy Operational Requirements



Lessons Learned

Harsh Environmental Conditions





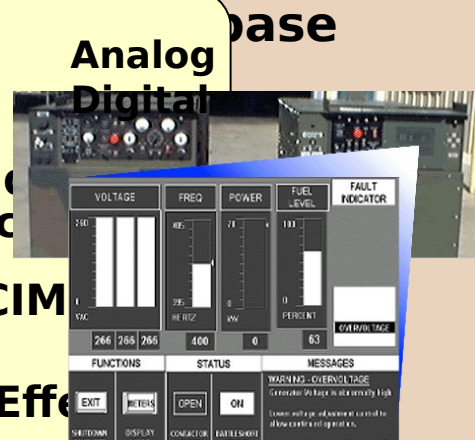
Iraq/Afghanistan Lessons Learned

- Power distribution - training/equipment/procedures
- High temperature operation critical
- Sand/dust impacts
- Solar loading (especially on displays)
- Preventative maintenance paramount (but not being done)
- Inadequate parts support -- sluggish
- Requirement for systems assessments

Environmental Impacts & MEP

Actions

- TQG Master Switch -
Developed Dust Proof Form, Fit, and Function Replacement Master Switch
- TQG Computer Interface Module (CIM)
Overheating Failures Resolved by Operational Techniques to Reduce Effect of Incoming Solar Radiation (Insolation) CI



Hurricane Katrina Relief Support

Hardware Provided by PM MEP

- 1 840kW DPGDS
- 1 60kW TQG
- 10 10kW TQGs

Camp Shelby
and
Hammond Airfield

Additional Generator Sets are
assigned to individual Military
Units supporting the relief effort

PEO C3T
Forward Deployed Task Force
PEO C3T Personnel
One MEP Representative



Generator Sets at
Camp Shelby



PM-MEP *Home Page*

- DoD Directive 4120.11
- TQG Technical Data
- “What’s New”

*□□ Performance Specification for
Military Mobile Power Sources
8 June 2005*

- Safety of Use Messages
- Organization and Points of Contact
- DoD Generator Master Plan
- Manuals, Tools, PLL/AS
- PS Magazine Articles
- References
(i.e. MIL STDs, ARs, etc.)



**www.pm-
mep.army.mil**

MORE !

***Comments / Recommendations
Solicited***

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